

Antibacterial Effects of Iron Oxide Nanoparticles in the Presence of Dispersing Agent

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Background & Objectives: In recent years, a rapid increase in microbes that are resistant to conventionally-used antibiotics has been observed. Thus, it is necessary to find an alternative treatment (perhaps without the use of antibiotics) for bacterial infection that is directed to the site of infection, localized, and difficult for bacteria to formulate resistance. The magnetic nanoparticles because of its magnetic properties has gained wide attention in biology.

Methods: The two important magnetic nanoparticles (iron oxide (IO) nanoparticles (γ -Fe₂O₃, Fe₃O₄) were used in present study. These (IO) nanoparticles were characterized by transmission electron microscopy (TEM) and dynamic light scattering (DLS), and then starch were used as dispersing agent. Further, 3-[4,5-dimethylthiazol-2-yl]-2,5-diphenyltetrazolium bromide (MTT) reduction assay and agar well diffusion methods were performed to study the antibacterial effects of five different IO nanoparticles concentrations with and without starch for 48 hours on *Staphylococcus aureus* (PTCC 1431), *Escherichia coli* (PTCC 1322), *Pseudomonas aeruginosa* (PTCC 1599).

Results: The DLS results showed the average size of them were an about 30-40 nm and TEM results demonstrated that IO nanoparticles were dispersed with starch and the microbial analyses results provide evidence that γ -Fe₂O₃ and γ -Fe₂O₃/starch nanoparticles did not inhibit bacterial growth even at the highest concentration (50 mg/mL). But Fe₃O₄ nanoparticles inhibited bacterial growth, specially at the highest concentration (50 mg/mL) and at the peresnt of starch.

Conclusion: Actually biocompatible starch as dispersing agent can reinforce the colloidal and magnetic stability of IO nanoparticles and subsequently can conserve and increase the antimicrobial effects of them. Thus Fe₃O₄ nanoparticles at the present of starch can be used as a good antibacterial agent.

Keywords: Iron Oxide Nanoparticles (γ -Fe₂O₃, Fe₃O₄); Antimicrobial Effects; Dispersing Agent; Starch